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ABSTRACT

This book contains a wide variety of winter-oriented ideas and activities that can be adapted to all elementary grade levels and can also be integrated into existing mathematics, science, social studies, and/or art programs. The activities aim to help students develop the skills of observation, appreciation, and problem solving as well as suggesting responsible behaviors toward the environment, each other, and snow equipment. Topic headings include: (1) Study Now Our Winter (establishing a theme and corresponding activities); (2) Stories in the Snow (with information and illustrations of animal tracks); (3) Snow and More Snow (listing experiments and activities to conduct with the snow); (4) Winter Waiting (highlighting facts and activities dealing with plants); and (5) Out and About (discussing winter clothing, insulation, and shelter). (ML)

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WINTER

HERE AND NOW

JOY FINLAY

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WINTER HERE AND NOW

by

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Illustrations by

JOAN HEYS HAWKINS

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FOUR R'S FOR HERE AND NOW

REALITY

"A frog in the pond is worth ten in formaldehyde."

Participating in first-hand experiences with ordinary real world phenomena

RELEVANCE

"We are surrounded but we know not."

Extending one's understanding of the real world from one's own frame of reference.

RESPONSIBILITY

"If you wish to live and thrive, let a spider run alive."

Making choices with a purpose and a regard for consequences.

RELATEDNESS

"Every thing is hitched to everything else in one universe."

Developing perspective on the web of life.

INTRODUCTION

A book of wonder can never be complete; for the more I do on the theme of winter, the more I find there is to do.

Winter Here and Now has been an ongoing project, with hundreds of students, teachers, leaders, and families who have joined with me in many winter discoveries. The first edition was printed by Alberta Recreation in 1972. Ten years later, a revised and expanded version was distributed to schools of the province by Alberta Environment, Communications Division. The present and fifth edition has been printed in order to meet the requests for further copies. Winter is the first in a series of four seasonal discovery books.

There is no such thing as a new idea, even when you have thought of it yourself for the first time. Thanks to so many who shared encouragement, enthusiasm, participation, and help in developing the idea of the book. Joan and I wish you many special winter adventures!

Jay Finlay

WINTER HERE AND NOW

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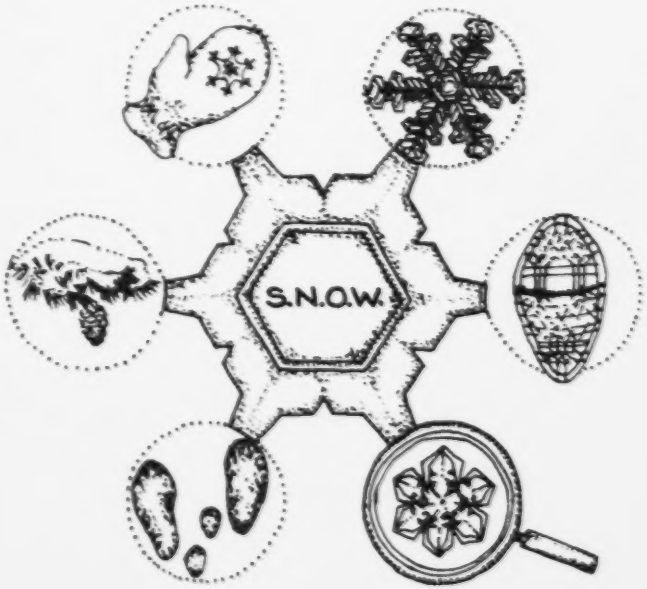
1

STUDY NOW OUR WINTER

Choosing a theme provides a way for organizing activities and focusing ideas for program planning.



1

① BUILD A S.N.O.W. PROGRAM WEB

A sense of wonder and excitement comes over me every time it snows. Like Thoreau, I marvel at those "glorious spangles, the sweepings from heaven's floor" and the mysteries they hold, especially of the number six. There's much excitement amongst the students too, as they come inside stomping the snow off their boots and shaking their soggy mitts. It becomes an interesting challenge for the teacher or leader to initiate a program of learning activities that integrates the here and now of falling snow, the reality of winter effects, and the students' various experiences and enthusiasms.

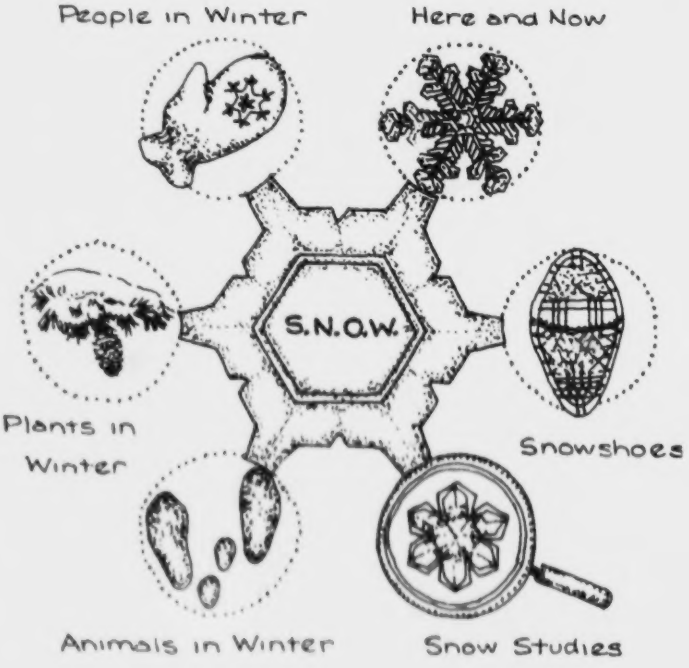
One effective way of developing a plan is to involve the students in brain-storming ideas for study around a theme. A starting point for planning may be an object or

an event such as a fresh snowfall or the arrival of new snowshoes. Snow provides a natural lead-in for many learning activities about the larger topic of winter. Using an organizing theme such as S.N.O.W. (the acronym stands for Study Now Our Winter), a hodge-podge list of ideas can be developed into a master web or flow chart. Bits and pieces become grouped and focused as relevant parts of a whole learning plan. Like a road map with alternate routes, it becomes a reference from which to subsequently choose and organize specific projects. The option for revising plans appropriately for time, situation and resources remains flexible. After ground rules have been established, the role of the teacher or leader becomes primarily one of helping the students help themselves. No one program could incorporate all of the ideas on the flow chart, so there is potential for stimulating carry-over by students into other classes, clubs, and home-time or

family pursuits.

Connections between components and the concept of interrelatedness are easily identified with the S.N.O.W. web. As a culminating "tie-up" activity, connect the interrelated components with string or yarn. The threads then visually represent the interdependence between components of our natural and human environments. These are the connections that make life and living possible in this winter world during a time of decreased energy budget from the sun. Tie in a bit of sunlight and call this the "Web of Life in Winter"!

② A S.N.O.W. FLOW CHART



(vi)
People in Winter
Dress
Food
Shelter
Travel
Recreation
Customs

(i)
Here and Now
Keep a log book
Responsibilities

(v)
Plants in Winter
Kinds of plants
Adaptation as food

(ii)
Snowshoes
History of snowshoes
Using snowshoes

(iv)
Animals in Winter
Tracks
Adaptations
Birds

(iii)
Snow Studies
Snowflakes
Snow Cover
Water cycle

S.N.O.W.:

ⓘ HERE AND NOW

What happens in winter?

Keep a log book

take pictures

Responsibilities

for:

ourselves

our equipment

our environment

S.N.O.W. :

(ii) SNOWSHOES

Where were they invented ?
How are they made ?

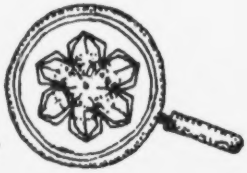
History of snowshoes

- types
- materials
- Indian names
- purpose
- style
- adaptation
- skis

Using snowshoes

- how ?
- when ?
- where ?
- choosing
- purchase
- maintenance

S.N.O.W.:



(iii) SNOW STUDIES

What causes winter?
What is snow?

Snowflakes
- crystals
- classification
- Eskimo words for snow

Snow cover
- temperature gradient
- depths
- layers
- density

Water cycle
- states of matter
- water sheds
- snow packs
- Where should snow be dumped?

S.N.O.W. :

(iv) ANIMALS IN WINTER

What do animals eat?

Tracks

- movement:
  - in snow
  - under snow
  - over snow

Adaptations

- survival
- food getting
- heat generation
- protection from cold
- conservation of heat
- heat loss:
  - convection
  - conduction

Birds

- food and feeders
- identification
- feathers
- down

S.N.O.W. :

Ⓥ PLANTS IN WINTER

How do plants survive?
Why do spruce stay green?

Kinds of plants
- twig identification
- deciduous
- evergreen

Adaptations
- above snow
- under snow
- seeds
- surviving cold

As food
- seeds
- buds
- fruit
- made in summer

S.N.O.W. :

(vi) PEOPLE IN WINTER

What effect does winter have on us?

Dress
- hypothermia
- frost bite

Food
- availability

Shelter
- building materials
- heating
- igloo
- quin-zhee

Travel
- snow tires
- salt on roads
- palm trees

Recreation
- parks
- resorts

Customs
- Festival of Light

③ THINK SNOW ?

INTRODUCTION:

Either bring some snow indoors or go out into some snow and think questions. Make lists of questions you would like to ask about snow — individually, in small groups, as a whole group. Expand to include think-starting questions about other aspects of winter — cold, coping, recreation, energy, food.

In the words of James Thurber:
"It is better to know some of the questions than all of the answers."

* When does it snow?
* How much does it snow?
* Is it ever too cold to snow?
* How does snow affect you?
* What do you do when it snows?
* Is all snow the same? different?
* How does snow change?
* How cold is snow? How can we find out?
* What good is snow? to you? to grass? to a mouse?
* What if snowflakes were pink?
* What problems are caused by snow on roads?
* What kinds of energy are used in snow removal?
* Where is snow dumped? Is it a "good" place for it?
* What if it never snowed?
* How does snow form?
* What is a white-out?
*
*
*

COLD:

* What causes the colder season of winter?
* How does cold affect the way we behave?
* Are people friendlier when they are warm?
* How do fashions change for cold? or do they?
* What kinds of clothing are available for keeping warm?
* How does cold affect traffic on the streets?
* How does cold affect sales? Is merchandise different in the stores?
* How does cold affect what is available in a grocery store?
* Does advertising change with changes in temperature? How?
* What kinds of things do we do to our homes to keep cold out and heat in?
* How much does it cost to heat a home?
* Is more gas used to drive a car in winter than in summer?

COPING:

* Are there more deaths in winter than in summer?
* What is hypothermia?
* What kinds of food and drink help keep you warm?
* How can we dress for being outside?
* Why are several thin layers of clothing better than one thick layer?
* Why are wool and down good insulating materials?
* What can you do to prepare for car failure?
* What could you do if you were stranded in a car?
* How could you survive a blizzard at home if there were a power failure over several days?
* How would you keep warm in your house if there were a fuel shortage?
* How would you build a house to conserve energy use?
*
*
*

RECREATION:

* What kinds of tourist facilities thrive in winter?
* What happens to sales of winter equipment when it snows? when it doesn't snow?
* What kinds of recreation activities are unchanged in summer and winter?
* What are popular winter sports? Where do they take place?
* Where did the snowshoe originate? the ski? the toboggan? the sled?
* How much energy is used to make an artificial ice rink? to heat a swimming pool?
* What means of snow travel have been invented?
* What effect do snowmobiles have in a park? on a ranch? on a roadside?
* What kinds of games do Eskimos play?
* How many bird feeding stations are there in your neighborhood?
*
*

* How many more questions can you think of?
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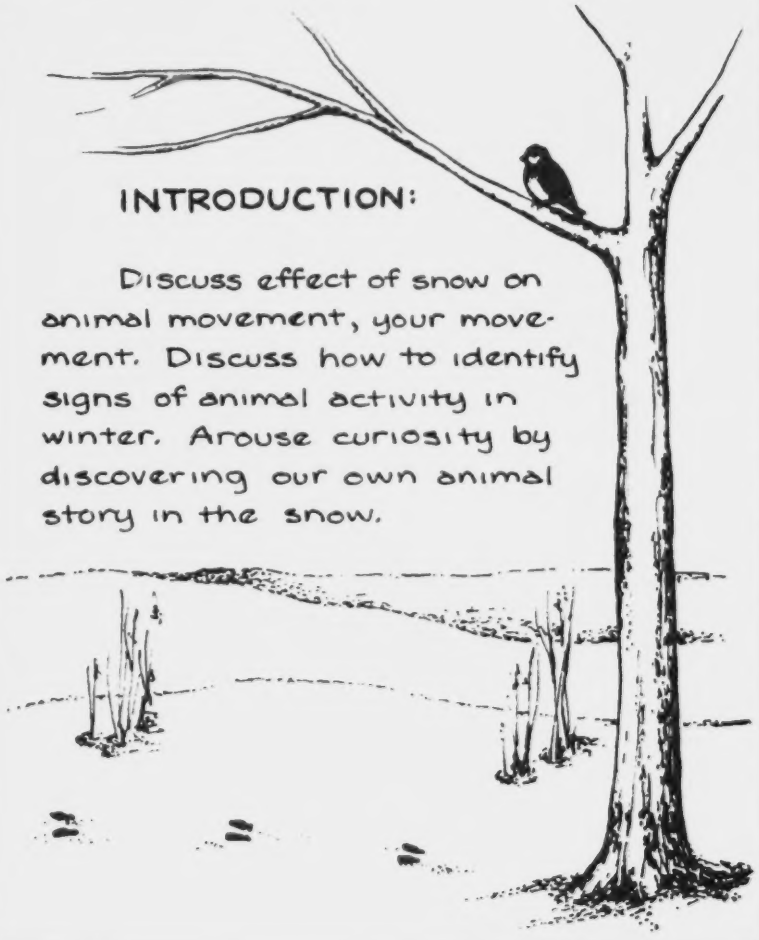
11

STORIES IN THE SNOW

Learning to read the visible signs of winter life is a special challenge on which to focus one's senses.

① READING STORIES IN THE SNOW



INTRODUCTION:

Discuss effect of snow on animal movement, your movement. Discuss how to identify signs of animal activity in winter. Arouse curiosity by discovering our own animal story in the snow.

OUTDOOR ACTIVITY IN A NATURAL AREA:

- Look for tracks and signs to discover which animals are active during the winter. Make listening stops often.

  Of some 90 mammal species in Alberta, about 1/3 remain active in winter.

  Of 300-plus bird species in Alberta, 1/10 are winter residents.

- How does snow affect their movement?

  Moose walk through deep snow on stilt-like legs. The varying hare walks on top of the snow, supported by snowshoe-like hind feet. Mice are active under the soft snow, sometimes tunneling to the surface

- What food is available? Signs of gnawing? Seeds scattered?
- Where do animals seek shelter?

  Take temperatures under the snow, above the snow, in exposed areas, and in shelter of trees. Ruffed grouse burrow into soft snow in very cold weather.
- Any territory marks?

  Many mammals mark their territory the way a dog does in passing a fire hydrant. Look for yellow stains at the base of trees or in holes in the snow.

FOLLOW-UP:

Consider and discuss similarities between the needs of wild animals and of people in winter.

② WHERE DO THEY GO IN WINTER?

- Red Squirrels remain active in the winter.
- Chickadees conserve body heat by huddling in old woodpecker holes. They feed on insects and eggs found on branches and in bark crevices.
- Most birds fly (migrate) to warmer climates.
- Purple Martins winter in Brazil.
- Winter is great for skiers.
- Meadow voles make runs in the grass under a blanket of snow.
- Snowshoes help to get around in the snow.
- Plants:
  Deciduous trees and shrubs drop their leaves each fall after forming leaf buds for next year's leaves.

  Perennial grasses and other plants die back to the ground each fall, putting out new shoots in the spring.

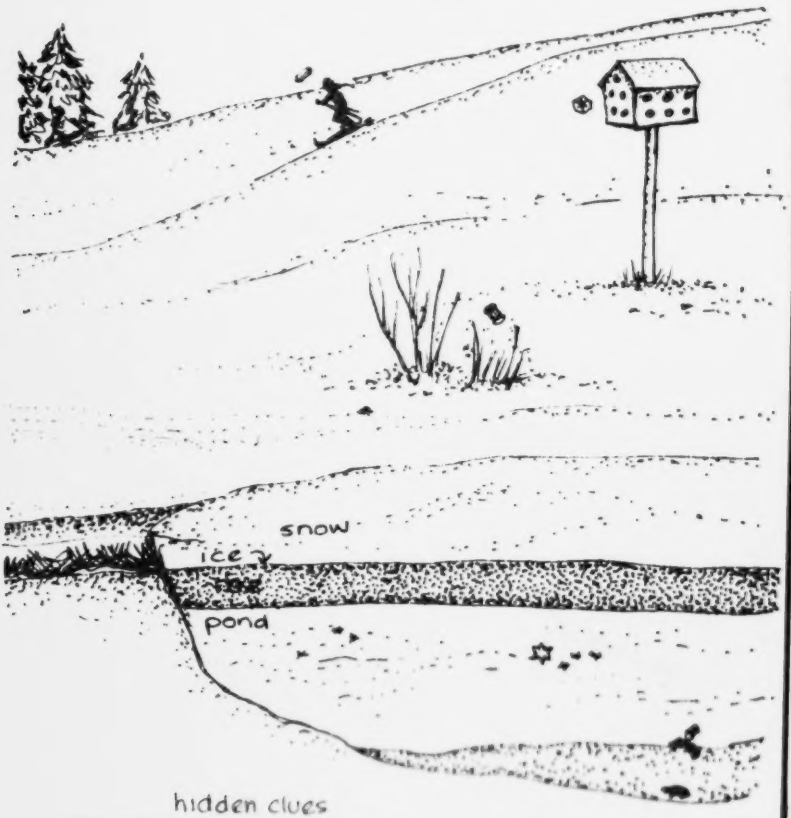
Many "weeds" are annuals that die each fall and start from seed in the spring.

- The Water Boatman survives in unfrozen water.
- Ground Squirrels, or "gophers", lie dormant below the frost line.
- Frogs bury in mud, barely breathing all winter.

Where do they go in winter?
Find the clues . . . .

WHERE DO THEY GO IN WINTER ?

Who hibernates ?
Who migrates ?
Who adapts... and how ?
What happens to those
who can't cope ?



hidden clues

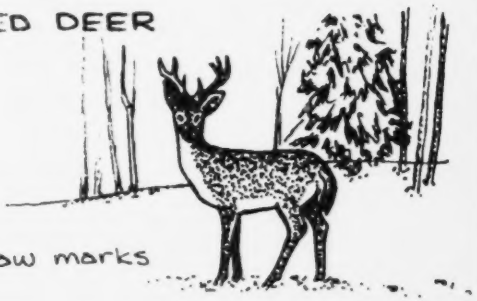
③ WHO GOES THERE?

- How many feet?
- How many toes?
- Are front and back feet alike?
- Any claws? Tail marks?
- Size of track - big or little?
- Heavy animal? Light-weight animal?
- Hopping? Walking? Jumping? Running?
- Which direction do tracks go?
- Over snow? Under snow?
- Where do tracks come from and where do they go?
- Other tracks? Same or different?
- "Whodunnit"?
- What story can you "read"?

DOG
claw marks
CAT
no claw marks
dog running
dog walking
cat walking
deer mouse
meadow vole
front
hind
DEER MOUSE
(tree climber)
MEADOW VOLE

WHITE-TAILED DEER

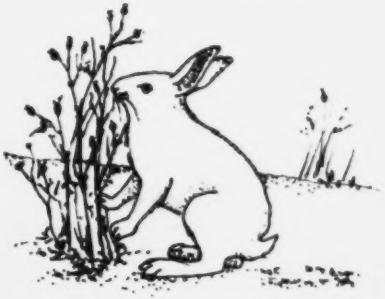
dew claw marks



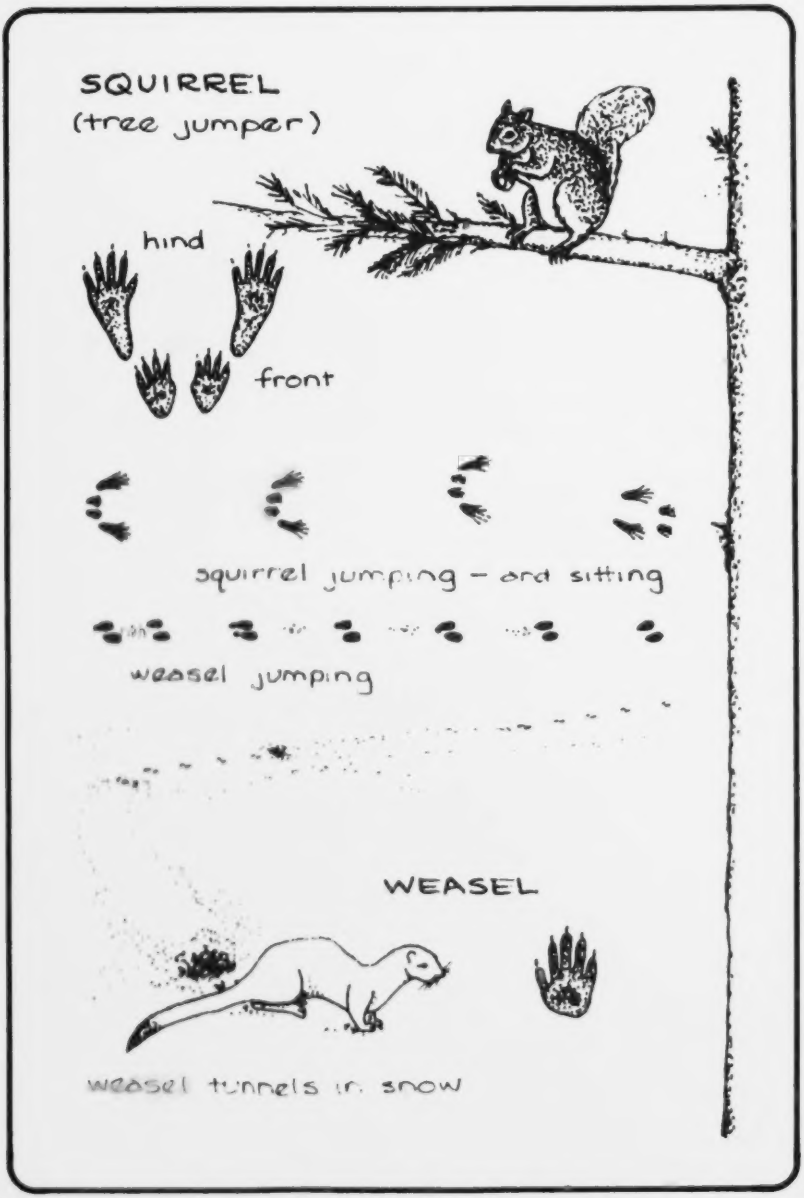
deer walking

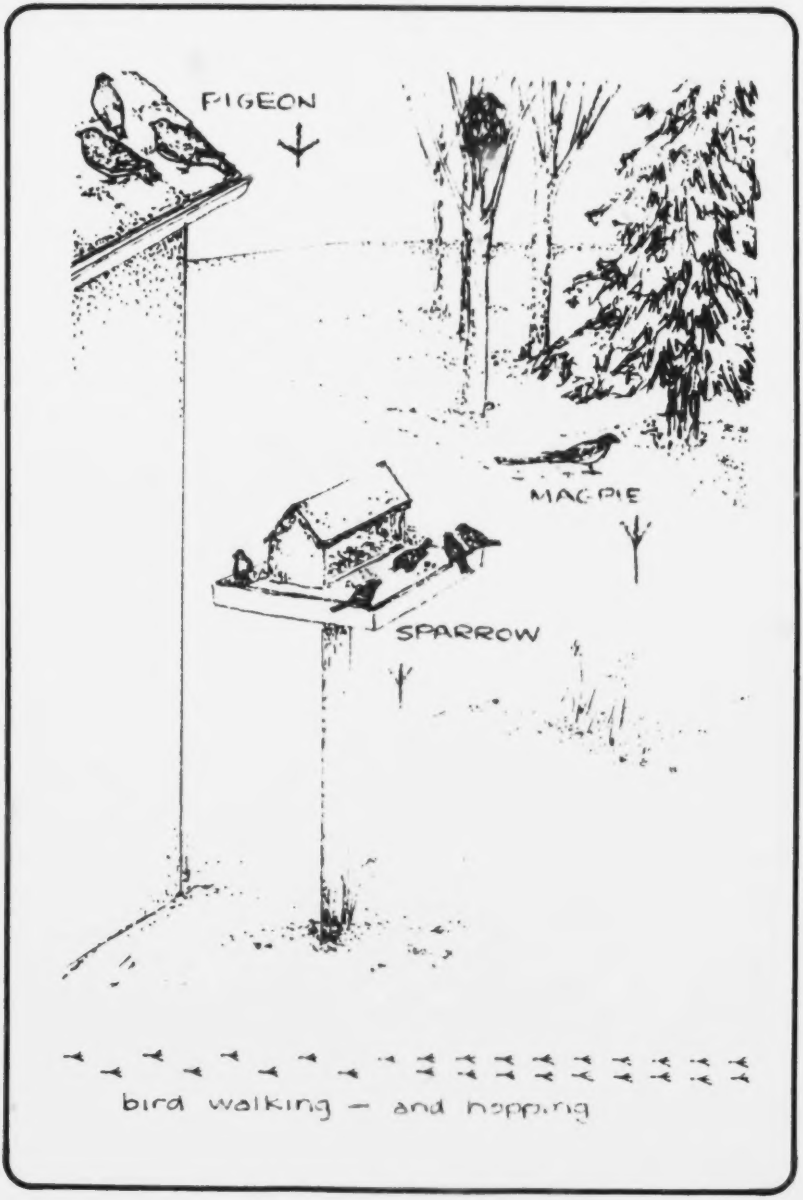
deer running

snowshoe hare hopping -- and sitting

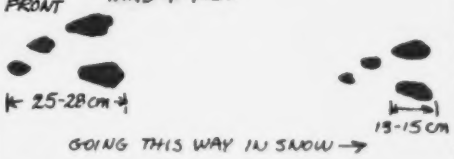


SNOWSHOE HARE


SQUIRREL
(tree jumper)
hind
front
squirrel jumping – and sitting
weasel jumping
WEASEL
weasel tunnels in snow


PIGEON
MAGPIE
SPARROW
bird walking — and hopping

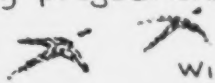
CLUE CHART FOR TRACK IDENTIFICATION

Sketch, Size, and Shape of Prints	Distance	Movement	Other	"Whodunnit"
	HOPS ABOUT 36 cm APART IN OPEN	HOPPING	- NO TAIL MARKS - BARK EATEN OFF POPLAR SAPLING	SNOWSHOE HARE

④ SNOW BOUND

A good winter for the Ruffed Grouse is one with lots of soft, deep snow. Search carefully through a poplar wood and you may find signs of where "the drummer of the woods" has walked, eaten, or made a tunnel in the snow.

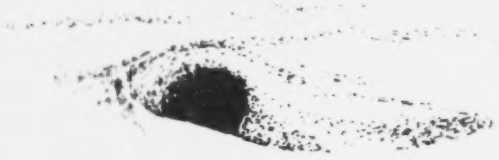
Grouse are equipped with "snow-shoes," horny projections on the sides of their toes. With toes spread wide, their tracks look like a series of crosses in the snow.



Check the rose bushes for signs of missing fruit. A Ruffed Grouse may walk along picking off rose hips, or fill his crop with leaves from the wintergreen exposed on the forest

floor. This small chicken-sized bird will balance high in the poplars, lunching on the leaf and flower buds of the tree.

Near dusk of a cold winter day, the grouse will plunge into soft snow. Once underneath, they will burrow and make a little snow cave that will hold their body heat and insulate them from cold air and wind. If you find a football-sized depression in the snow, look for chicken-like droppings about 2 cm long as further proof of who has been there.



Imagine the plight of a grouse who, after spending a safe night in a snow burrow, wakens to find that freezing rain has formed a crust over the snow! He may be a prisoner under the snow for days. He will make long tunnels and many attempts to peck through the crust. Perhaps a deer might pass by and break the

crust. What if a coyote came by and sensed dinner under the snow? Or a snowshoer might pass by, just missing one grouse beneath. The flutter of a bird bursting out of the snow would be some surprise!

⑤ BLACK DOT PHENOMENON

The first spider on top of the snow on a sunny day in later winter may be a clue that tiny insects are out. Looking closer, there may be black dots all over the snow. If the black dots jump when a finger is placed near them, we know they are not dust. They are springtails, or Collembola, one of the most primitive insect orders alive today.

These tiny snowfleas, which have no relation to real fleas, have no wings. A forked appendage is tucked

under their bodies. When the insects are frightened, this spring is released, triggering their jumps. In one jump, these tiny insects cover a distance that is sixty times their length. They are about 6mm long. Imagine making a leap sixty times your own height!

Snowfleas are widespread. Look for them struggling upward through the snow during bright days in late winter — in backyards, meadows, fields, and woodlands. They live in Antarctica and in Alpine regions all over the world. Their food is fungi, spores, pollen, and microscopic plants or animals. Not many other insects are active in the snow; thus, competition for food and space should not be a problem.

Cross-country skiers have been puzzled over "dust" inside a moose footprint track, or "shadows" on the walls of a snow bowl around a tree. Millions of snowfleas gathered on the sunniest side of a depression in the snow give this shadow or dusty effect. A shrew, a tiny mouse-like

insectivore who needs nearly its own weight in food each day, could have a real feast on such a gathering of snowfleas.

FIELD NOTES ON SPRINGTAILS

Include:

Date:
Temperature:
Snow depth:
Site description:
Microhabitat description:
Other wildlife:

⑥KEEP ON TRACKING

ARTS:

- Try making plaster casts – it's not easy, especially when it is cold.
- Make sketches of tracking patterns.
- Trace tracks on a clear plastic sheet placed over the track, using a felt liquid pen.
- Create a drama and role play an interpretation of events.
- Adapt the words of a familiar tune, such as: "There's a track at the base of the tree..." instead of: "There's a hole in the bottom of the sea..."

MATH:

- Measure distance between imprints.
- Average distances between tracks and calculate how many steps or paces per metre, kilometre, or other defined distance.
- Chart results on a graph to show a comparison of size of animal with size of tracks.
- Early measurements were based on lengths of thumbs, feet, strides, etc. Can you use your own "measuring tools" for tracking?

SCIENCE:

- Classify tracks according to type of moving activity: hopping, walking, jumping, climbing, crawling.
- Using a field guide, identify tracks and classify according to animal groups.
- Make your own pocket-sized "Tracks and Animal Sign Book."
- Make tracking stories in the snow. Record and interpret each other's stories; include what, where, why, and when.

LANGUAGE ARTS:

- Write a short story about the observations made.
- Write a news item for readers in a tropical climate, in Australia, or an imaginary community in outer space.
- Research and report on the habits, life history, and distribution of an animal whose tracks were identified.
- Have a spelling bee, or make a crossword puzzle with words relevant to the tracking project.
-
-
-
-
-
-
-

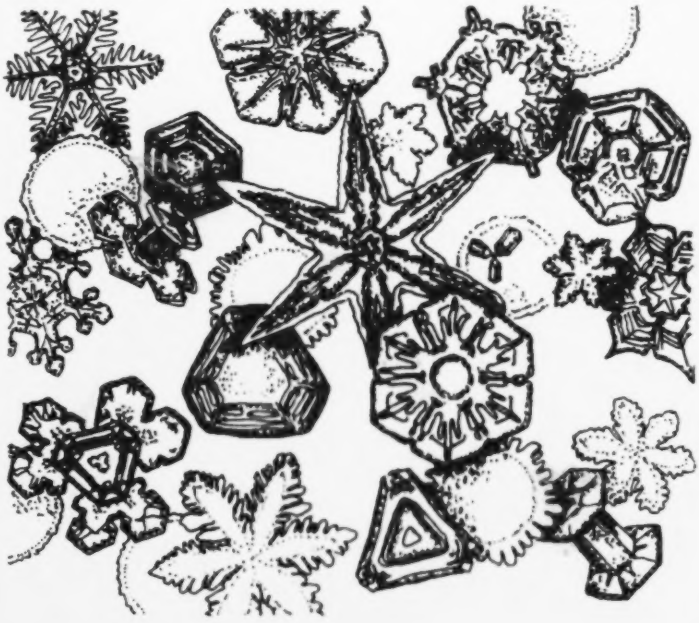
SOCIAL STUDIES:

- ✓ Compare the way of life in a natural community to that of your own community. Create skits or dioramas to illustrate.
- ✓ Identify and compare jobs (niche) — producers, consumers, decomposers.
- ✓ Identify and compare addresses (habitats) and why each animal (people, too) has special places to live.
- ✓ Discuss or debate the value of wildlife to quality of life today, in times past, and in the future.
- ✓ List professions related to wildlife and their habitat.
- ✓ Find magazines about animals, nature, and conservation.
- ✓
- ✓
- ✓
- ✓

III

SNOW AND MORE SNOW

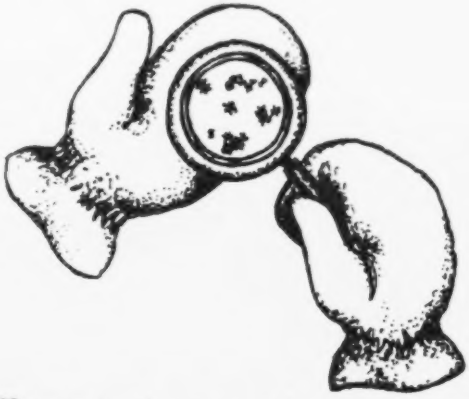
"What a world we live in! where myriads of these little disks, so beautiful to the most prying eye, ... sing of the mysteries of the number six,— six, six, six, six." —Henry David Thoreau



① A SQUARE METRE STUDY IN A SNOW PATCH

INTRODUCTION:

@ When it is snowing, catch a mittful of falling snow. With a magnifying glass have a look at kinds, shapes, differences and likenesses among them. Compare with Snow Crystal Classification.



Different shapes of crystals are a result of various atmospheric conditions in the cloud level

and near the earth's surface.

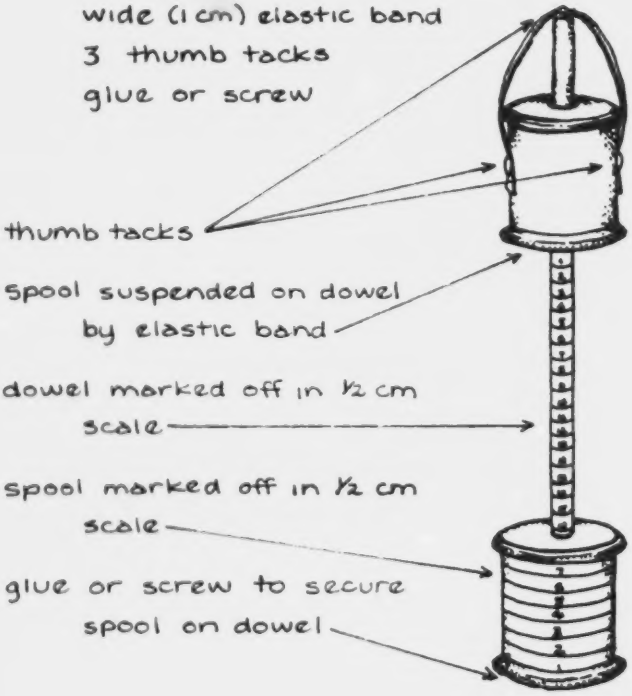
- Assemble and "manufacture" a snow study kit. Suggestions for making instruments are on the following pages.
- By way of discussion, consider how snow modifies the environment, and how snow itself is modified.

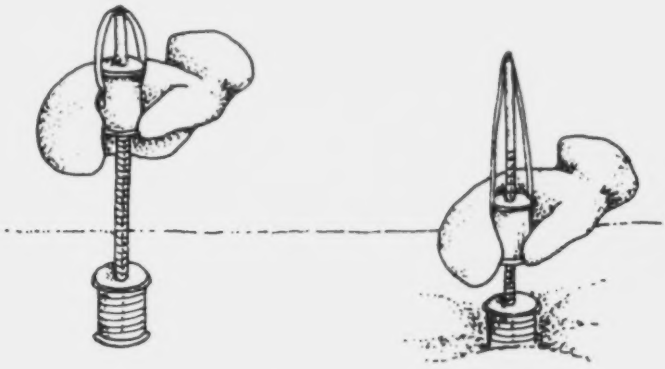
SNOW HARDNESS GAUGE

This instrument may be used for vertical or horizontal measurement to show relative hardness of snow surface or profile.

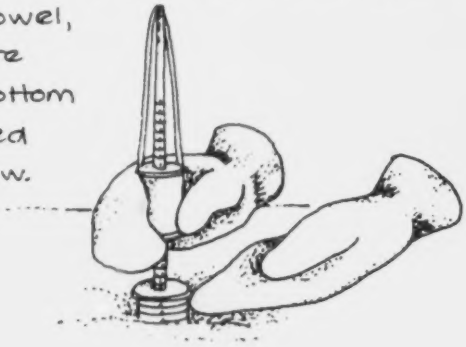
Materials:

24 cm of ½ cm dowel
2 empty thread spools
wide (1 cm) elastic band
3 thumb tacks
glue or screw


thumb tacks
spool suspended on dowel by elastic band
dowel marked off in ½ cm scale
spool marked off in ½ cm scale
glue or screw to secure spool on dowel



To use, hold by the top spool, carefully pressing bottom spool into snow. Measure distance the top spool moved down the dowel, and measure depth the bottom spool pressed into the snow.



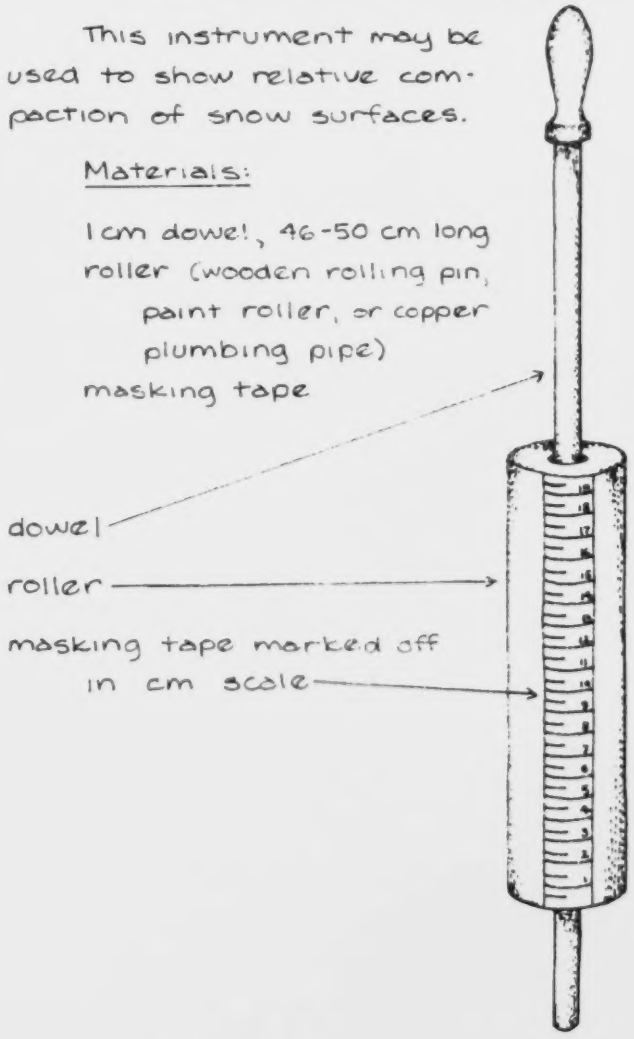
Compare measurements in several places in a yard or field.

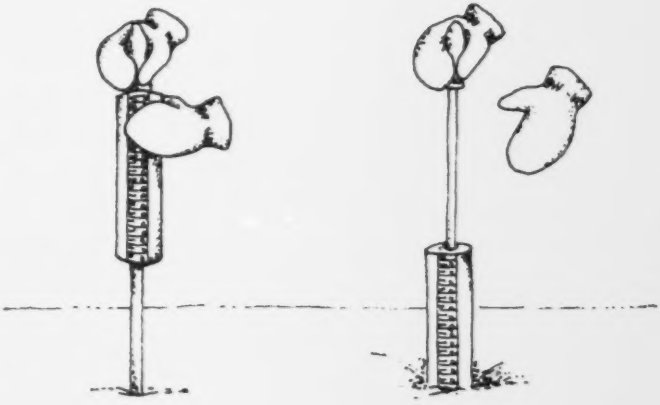
SNOW COMPACTION TESTER

This instrument may be used to show relative compaction of snow surfaces.

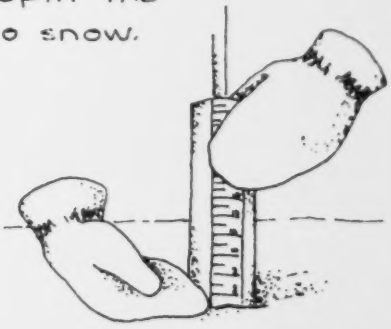
Materials:

1 cm dowel, 46-50 cm long
roller (wooden rolling pin, paint roller, or copper plumbing pipe)
masking tape





To use, hold dowel upright at snow surface. Drop roller down. Measure and compare depth the roller sinks into snow.



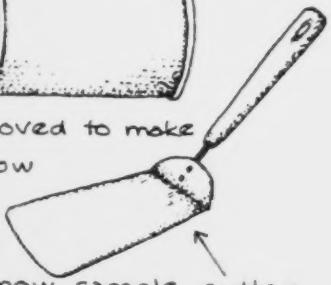
Compare snow compaction in several places — under trees, in the open, on a driveway, in a flower bed.

SNOW DENSITY INDICATOR

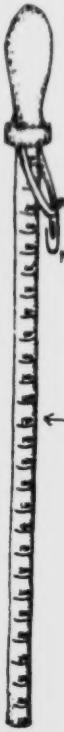
This instrument may be used to show relative densities of snow samples.

Materials:

284 ml soup can with both ends removed to make a cylinder (snow sample cutter)

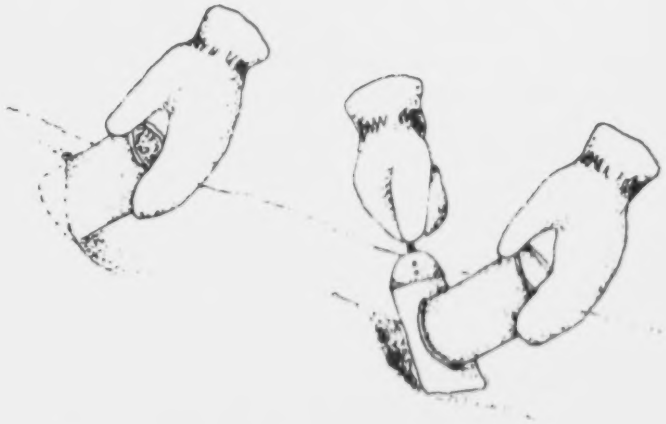


egg turner or piece of tin (snow sample cutter back)

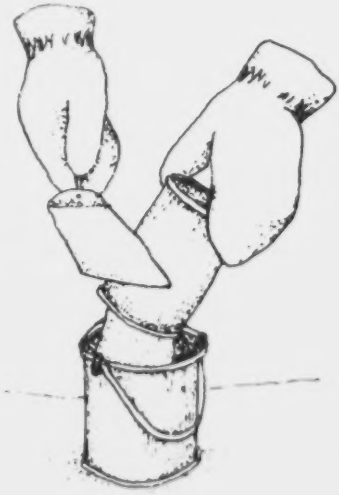


a small spring scale or dowel scale for weighing:
elastic band attached to dowel
paper clip hook
30 cm of dowel marked off in mm scale

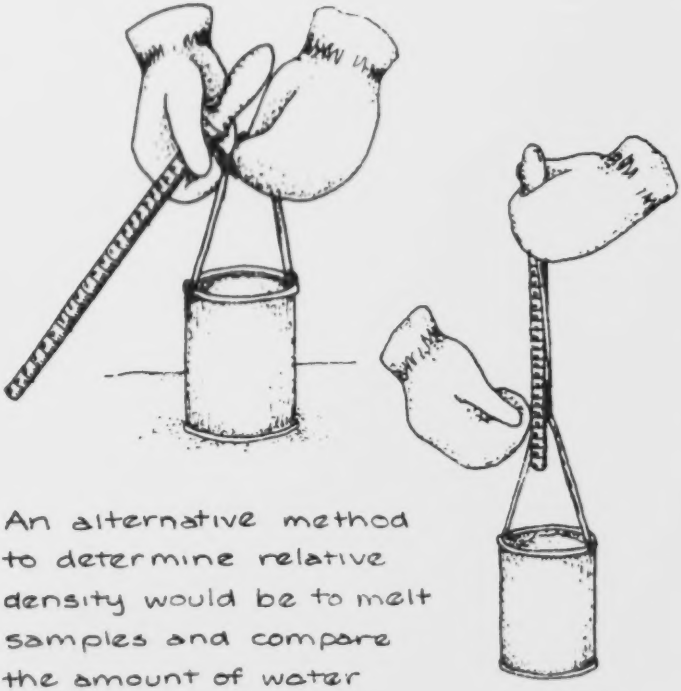
398 ml can with one end removed, and string for handle (weighing bucket)



To collect snow samples of consistent volume, carefully push snow cutter into snow until it is filled. With tin or egg turner back, hold sample in can while removing it into weighing bucket.



With snow sample now in bucket, weigh on spring scale or dowel scale.



An alternative method to determine relative density would be to melt samples and compare the amount of water yielded.

Density of snow influences the insulation quality of the snow blanket.

OUTDOOR ACTIVITY IN A SNOW PATCH:

- Upon selection of a square metre site in a yard or field, begin making observations on the surface of the snow. "Read" any signs that are there.

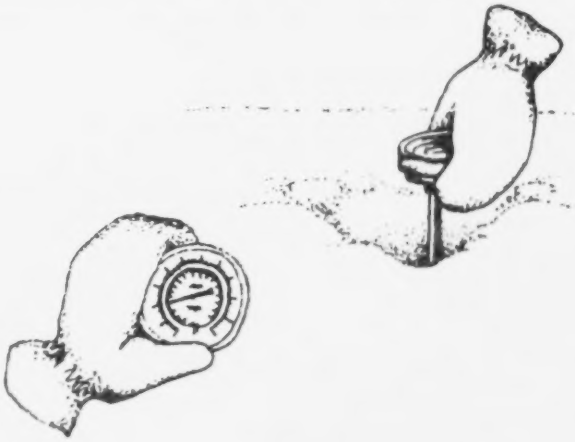
  Use a thermometer to record temperatures in the air and at the snow surface.

  Measure surface hardness with a Hardness Gauge or Compaction Tester.

  Look at snow grain size and form with a magnifying glass. How does it compare with falling snow? Notice how quickly fallen snow changes.

- Dig a small pit. Take a temperature reading in the snow at ground level. How does it differ from air temperature? Snow cover is often referred to as winter's blanket, insulating

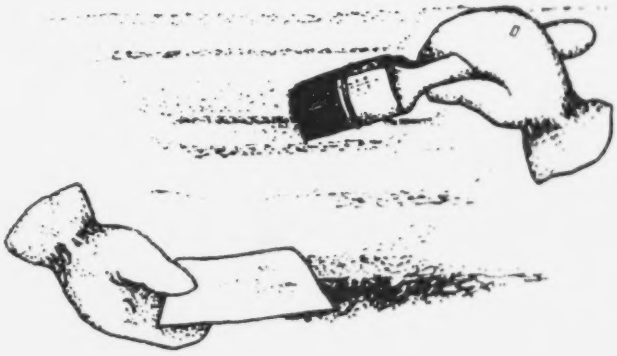
soil and plants from freezing.



With a metre stick, measure depth of snow cover. Imagine life in a subnivean (below the snow) world — dark, moist, quiet, with a moderate and relatively constant temperature.

Study the profile of the snow wall for evidence of different layers or snowfalls. How many layers can be detected? Measure and compare depths. How many snowfalls can you recall?

Compare grain size and form at different layers.



Weigh snow samples from several layers with a Snow Density Indicator.

Test layers for hardness with a Hardness Gauge.

- Make similar studies in several snow patches and compare data. How might differences or similarities be explained?
- Study the same snow patch at monthly intervals.

FOLLOW-UP DISCUSSION:

Just think how many billions of beautiful snowflakes it must take to make a square metre of snow!

Assume the role of transportation engineer, wildlife biologist, small mammal, or plant, and discuss the significance of the physical and thermal properties of snow cover on living. Take into account the changing characteristics of the snow cover.

② SNOW TALK

Kobuk Valley (Alaska) Eskimo Words for Snow:

* Qali: snow that collects on trees

* Qamaniq: the deep bowl-shaped depressions in a snow cover which form under coniferous trees

* Api: fallen snow on the ground

* Pukak: the lattice-like layer of snow just above the earth, under a mature snow cover

English description	Cree (Alberta)	Shuswap Dialect (British Columbia)	Kobuk Valley Eskimo (Alaska)
snow	koona	jwooht	anniu
snow that collects on trees	eyẽkwatin		qali
fresh snow	oskimispon	jmohòp	
melting snow	suskun	jtèmwh	
snow on the ground	kooniwun		api
drifting snow	pewunūtin		siqoq
layer under snow	muskowkoonawum		pukak
icẽ	muskwamẽ	jhòien	

③ SNOW CLASSIFICATION

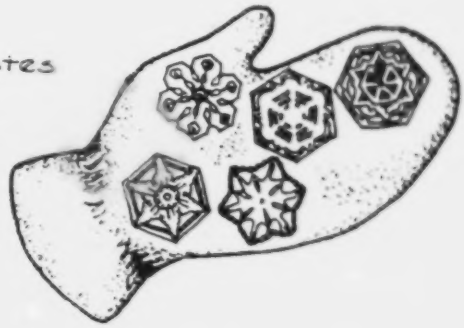
Snow is a form of solid precipitation formed in the atmosphere by sublimation of water vapour.

The seven main types of snow crystals listed here are based on the International Snow Classification and are intended for falling snow. Snow crystals undergo changes when they reach the ground and lose their original identity.

The term "snowflake" is restricted by meteorologists to a cluster of snow crystals which have become stuck together while falling.

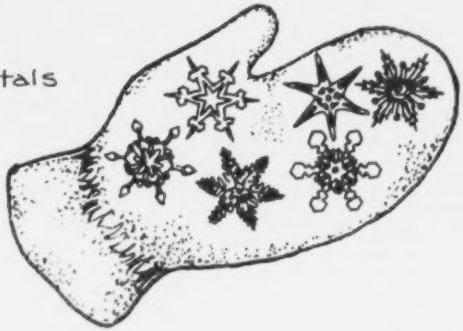
Hexagonal Plates

Symbol:



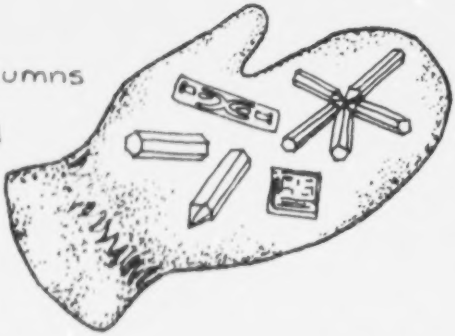
Stellar Crystals

Symbol: ✳



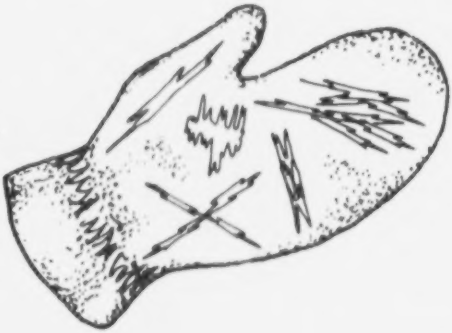
Hexagonal Columns

Symbol: ▭



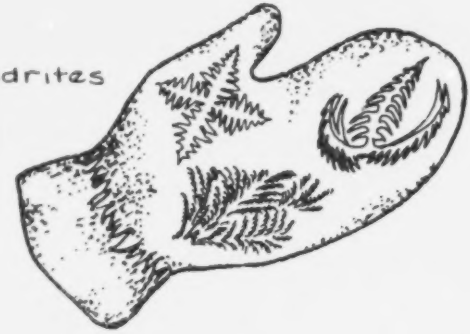
Needles

Symbol: ⟷



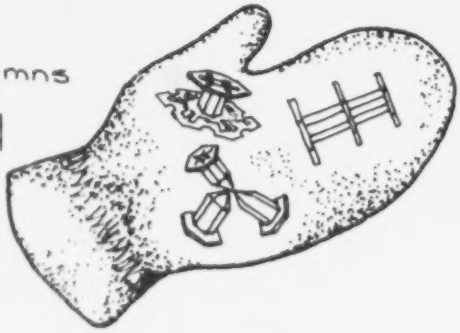
Spatial Dendrites

Symbol:



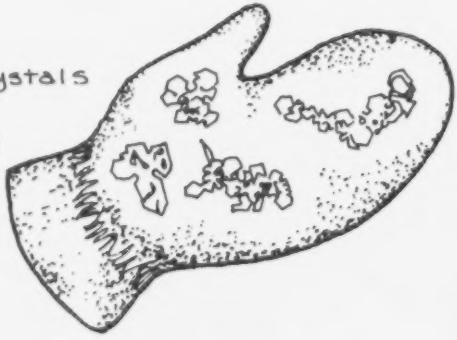
Capped Columns

Symbol:



Irregular Crystals

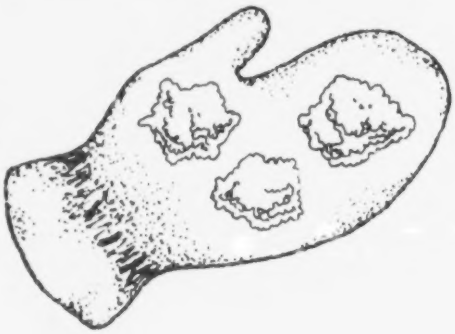
Symbol:



Also called "snow pellets," graupel are snow crystals with a thick icy coating.

Graupel

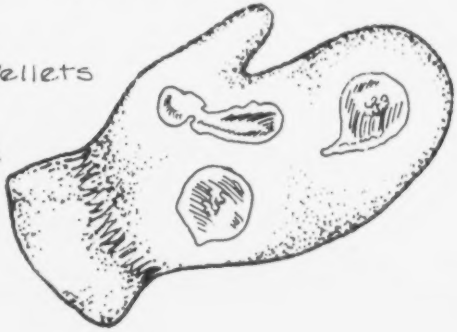
Symbol:



Sleet is frozen rain drops, usually small and transparent.

Sleet or Ice Pellets

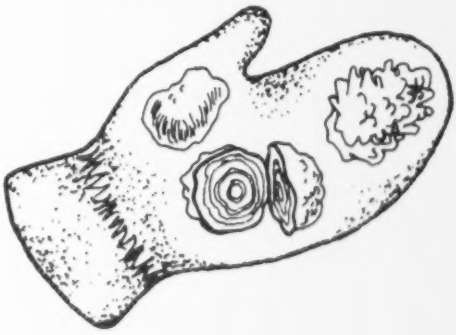
Symbol:



Hail is solid precipitation formed by successive freezing of water layers and growing outward from a solid centre in semi-transparent layers.

Hail

Symbol: ▲

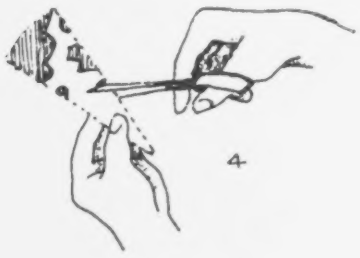


④ SNOW JOBS

ARTS:

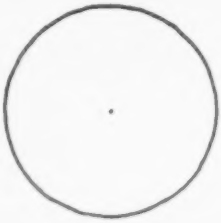
- Look for colours, shapes, and patterns on the snow, in shadows, in snowflakes.
- Find colours to match bark, sky, berries, fallen leaves. Notice colours of objects near and far. How can you tell which are near and far (perspective)?
- Design a snowflake to illustrate a perfect six-sided stellar crystal:

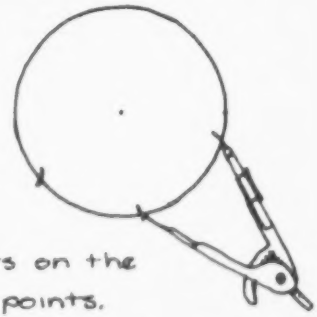
Fold a circle of paper in half (1); in half again (2); then in thirds (3). Cut out design (4) and unfold.



MATH ART:

- Find ways to draw perfect 6-pointed snowflakes. Try using a compass to find the 6 equi-distant points on the circumference of a circle.





Hint: the radius fits on the circumference at 6 points.
What are the chances of finding a perfect 6-armed snowflake in nature? Check for symmetry of snowflakes next time it snows. What do we mean by "perfection"? Is nature always "perfect"?

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SOCIAL STUDIES:

- Contact local travel agencies to find out how winter conditions affect tourism in Alberta communities, in Provincial and National Parks. Compare winter visitation in and out of an area with that of summertime.
- Snow is a significant factor in the economics of transportation. Follow the imaginary journey of a grain of snow on the road nearby, on a major highway, or on an airport runway.
-
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SCIENCE:

- Freezing is an interesting process. Compare snow and ice crystals. Both are solid forms of water having an orderly arrangement of molecules. Snow is formed in the atmosphere by sublimation of water vapour passing directly to a solid without becoming a liquid.
- Sublimation project: Hang a wet towel out to dry when it is below freezing. Notice that the towel freezes stiff, but periodic checks throughout the day or days show that it becomes limp and drier. What happens to the frozen water in the towel? Does it sublime from ice to vapour?
- Life depends on the sun's energy. Less energy input, less plant output; less plant input, less animal output. How does the rotation of the earth on its axis affect a snowflake or a rose-bush in your own yard? How does the rotation of the earth on its axis affect animal life – migration, hibernation, reproduction, and populations?

RECREATION:

- Note the different kinds of snow and consider which kinds are best for skiing, sledding, snowshoeing. Experienced skiers use different waxes to cope with the many types of snow.
- Just for fun, try a relay race with a snowball – mitts off. Take into account the factors that determine how quickly snow melts and plan strategy accordingly.
- Snowshoeing is happiness! Before starting out, be prepared to preserve and care for the area you are in, the equipment used, and yourselves.
- Should you eat the snow? Check for visible impurities by melting two cups of snow – one through a filter and one unfiltered. The freshness of the air may be checked in the same manner, using new-fallen snow.
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-
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IV

WINTER WAITING

For plants, winter is a time of waiting—a bridge between summers of food-making and growth.

① A WINTER SCENE

In summer we are surrounded by green plants and living things. What happens when winter comes? How do the different plants and animals survive when temperatures fall below freezing and snow comes to cover the ground?

By nature's impartial rules, living things must adapt or perish.

Animals of our north temperate climate are adapted to migrate, hibernate, or stay and cope with winter conditions. Plants are adapted to surviving winter in various forms — exposed above the snow, protected under a snow blanket, dying back to underground roots or bulbs, or as annual seeds.

Enjoy the beauty of a snow-laden wonderland and observe the various forms of plant life that make up

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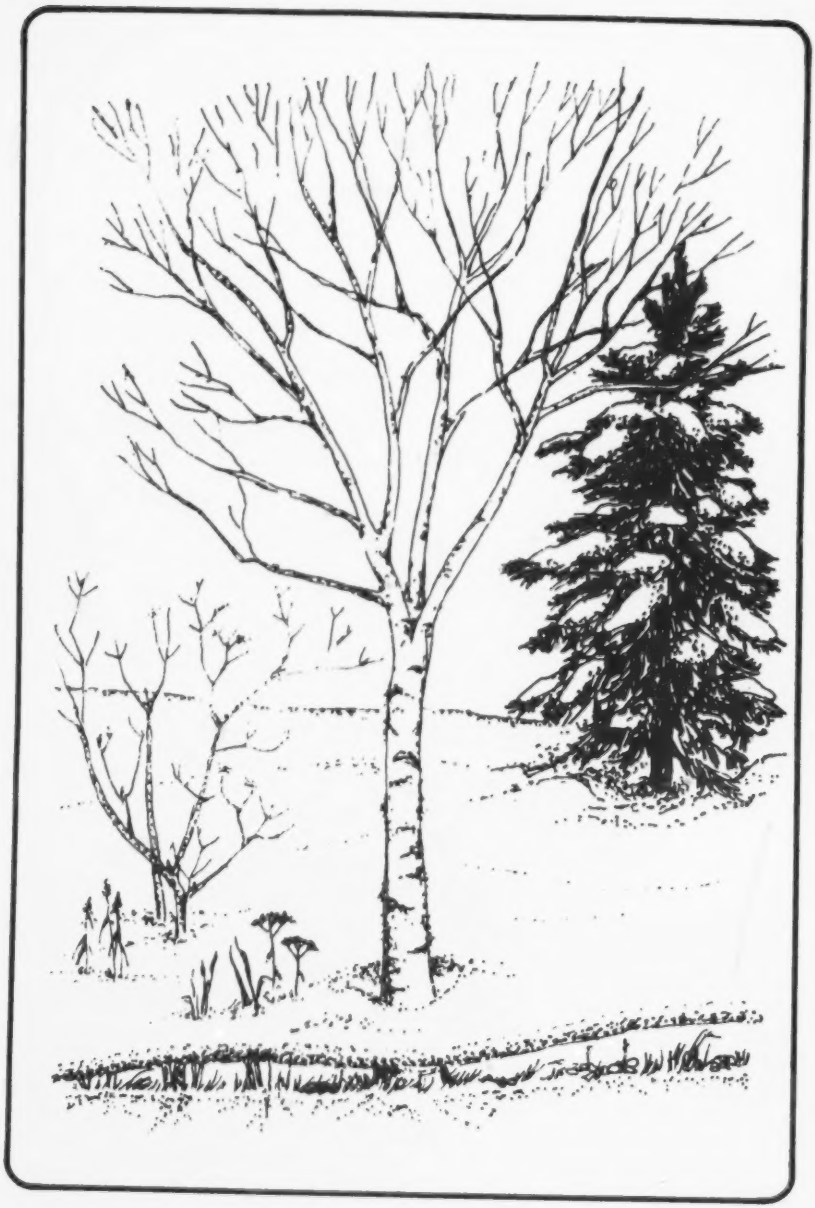

a winter scene.

Which ones are evergreen?
Are evergreens always trees?
What advantage is it to stay green?
Notice the conical silhouette of the conifers, exposing the most needles to the light. Look for more evergreen plants beneath the snow. The wintergreen, twinflower, and most mosses — like the spruce, pine, and fir trees — stay green and ready for spring.

Which trees are deciduous?
Where will new leaves come?
Deciduous trees drop their leaves in preparation for a long winter wait. Summer food-making and growth cannot continue under winter conditions of cold temperatures, low light, and unavailable moisture.

Which ones have died back to the roots?
Are there plant skeletons?
Any evidence of seeds?
In cold weather, the snow blanket insulates the ground from deep freezing air temperatures. This is essential

to the hibernating mammals and allows bulbs and roots of plants to overwinter

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② FINGERTIP IDENTIFICATION OF CONIFERS

Search the ground under an evergreen tree. Pick up some fallen needles and use your fingers to help identify the tree.

Place a needle between thumb and forefinger to feel its shape. Does it roll easily? Is it round? squarish? flat?

Look at the needles on a branch to see how they grow. Are the needles borne singly? in twos? threes? clusters?

Are there cones on the tree? on the ground?

Knowing the shape of the needles and a few obvious characteristics, it

becomes easy to distinguish a spruce from a pine or fir. Using the fingertip key for identifying evergreens (or conifers) is an exercise in comparing and contrasting similarities and differences, a basic skill required for more specific identification of tree species. An identification key is an aid used by botanists and naturalists to find the name of a plant.

Notice the phonetic gimmick in the key that fits the shape of the needle with the name of the tree.

SQUARE
SPRUCE

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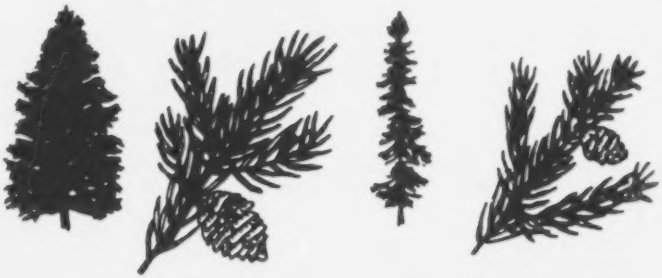
A. Needles borne singly on a branch:



White Spruce Black Spruce

Cross-section of needle: ◇

1. If needle rolls easily, is 4-sided, feels **SQUARE** . . . . .
   it is a **SPRUCE**.

Balsam Fir Douglas Fir

Cross-section of needle: ⬭

2. If needle does not roll easily, feels **FLAT** . . . . .
   a. it is a **FIR**
   b. or a Douglas Fir.

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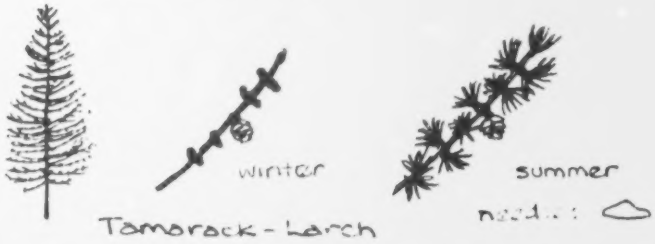
B. Needles borne in clusters of two or more on a branch:

Lodgepole Pine Jack Pine

Each needle in cross-section is ½ to ⅕ of a "pie":

1. If there are 2, 3, or 5 needles in a cluster, and when pinched together they form a circle or a PIE..... it is a PINE.



Tamarack - Larch needle:

2. If there are 10 to 40 needles in a cluster on a short spur-shoot, a deciduous "evergreen" with LOTS of needles in a cluster..... it is a LARCH.

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③ TWIG DETECTIVES

Take up the challenge of being a twig detective and identify the deciduous trees in the winter woods.

The color, shape, size, and arrangement of buds on a twig are important characteristics for recognition.

Read the clues to determine rate of growth, age of twig, where old leaves were, and where new leaves will come.

Compare different tree silhouettes against the winter sky.

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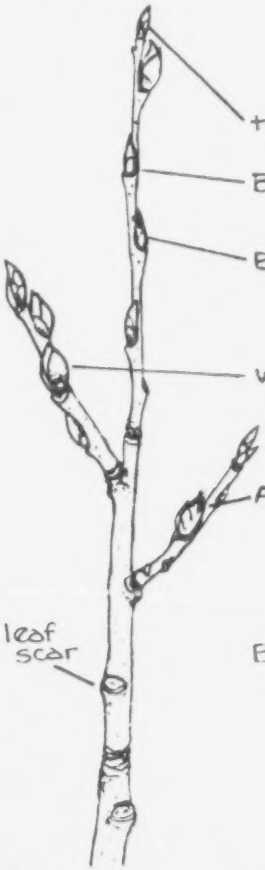
Trembling Aspen

Populus tremuloides



terminal bud

Buds and leaf-scars are alternate.

Bud scales are reddish-brown, smooth, and roundish.

When present, flower buds are larger than leaf buds.

A relative of the willow, the furry flower may show beneath the bud scales.

Bark is smooth, greenish-gray with white powdery bloom on the sunny side, becoming darker and textured in age.

Other common names include white poplar, aspen, quaking aspen, and aspen poplar.

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Balsam Poplar
Populus balsamifera

Buds and leaf-scars are alternate.

Bud scales are large, pointed, and resinous. When warmed, have a distinct odor, a promise of spring.

Note the "face" in the leaf scar, made up of three bundle scars. Bundle scars are tiny dots, the remains of the conducting tubes that ran between stem and leaf.

Prominent annual growth rings show where terminal buds were in previous years.

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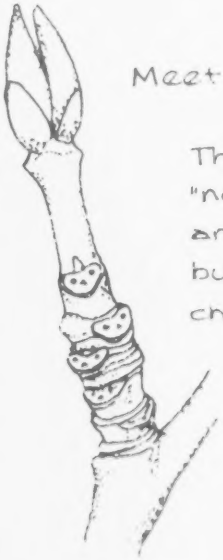
Deeply furrowed gray-brown bark and full crown on mature trees.

Other common names include black poplar and poplar.



Meet a Twiggy Family

The two "eyes" and a "nose" in each "face" are the vascular bundle scars. The characteristic "faces" are an aid to recognizing different trees and shrubs in winter.

Birch

Betula papyrifera

Buds and leaf-scars are alternate.

Seed catkins disperse butterfly-shape seeds and fleur-de-lis-shape scales in winter.

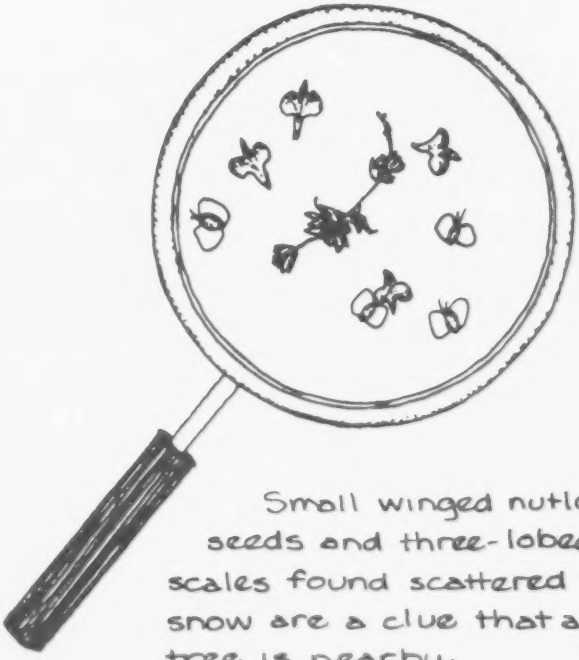
The male flower catkin, formed before the leaves fell, is ready and waiting for spring. The female flower catkin is hidden in a bud.

Distinctive cross-marks are lenticels that act as breathing pores.

White, paper-like bark on mature trees; dark reddish-brown bark on immature trees. Prominent lenticels on bark.

91

Other common names include white birch, paper birch, and canoe birch.



Small winged nutlet seeds and three-lobed seed scales found scattered on the snow are a clue that a birch tree is nearby.

92

Alder

Alnus tenuifolia

Buds and leaf-scars are alternate.

Leaf buds are on a stalk.

Dark brown, cone-like seed catkins in small clusters.

Next spring's flower catkins are visible. The elongated catkin is the male; the stubby catkin is the female.

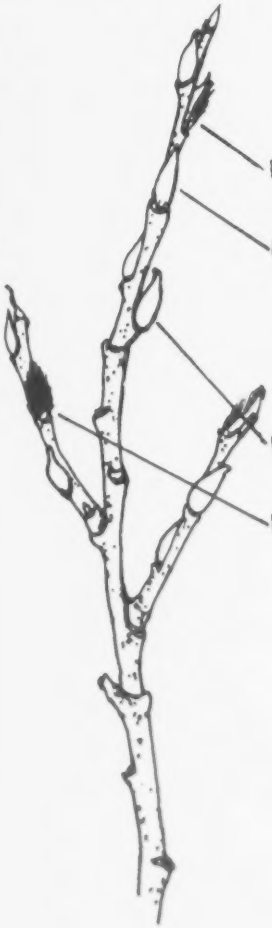
Bark is dark reddish-brown with noticeable lenticels.

As a small tree or large shrub, the elder is found bordering wet areas and river sides.

Other common names include river alder and thinleaf alder.

93

Willow
Salix species



Buds and leaf-scars are alternate.

Each bud is protected by a single bud scale. Bud scales are smooth, shiny, dark brown to reddish-brown.

Flower buds are larger than leaf buds.

Distinctive pussy willow flowers may show in winter.

94

Red-Osier Dogwood
Cornus stolonifera

Buds and leaf-scars are opposite.

Pairs of narrow leaf-scars give stem a jointed appearance.

Flat-topped spray on which flowers and fruit were borne.

A multi-stemmed shrub showing a deep-red color in winter.

One of several shrubs common in wooded areas and along river banks.

Other common names include dogwood and kinnikinnick (the inner bark was used as a tobacco).

95

④THE UNDERSTORY

Under the tree canopy of mixed poplar woods is the understory. The plant forms of shrubs, herbs, and young tree saplings typically form distinct layers or strata. The understory layers provide food and shelter for animal occupants who remain active in winter. Seeds, berries, buds, and bark produced in the summer provide food for winter survival.

The bright red rose hips provide high-energy food for berry-eating birds, squirrels, and mice.

The snowshoe hare nips off new growth branches and terminal buds. Note the knife-like diagonal cut.

96

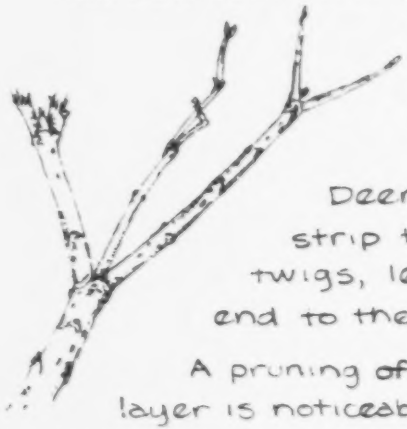
Redpolls are among the birds that feed on the seed catkins in the birch tree. Seeds that fall provide food for mice and other ground feeders.

The crib-board pattern of holes on the trunks of trees, often birch, show where the yellow-bellied sap-sucker found food in the summer. Unable to find food (sap and flying insects caught in the sap), the sap-sucker takes the Mississippi flyway and spends the winter in Florida.

Branches with tent caterpillar egg rings are a winter source of food for chickadees.

Many birds - woodpeckers, chickadees, kinglets, nut-hatches - search in cracks and on branches for dormant insects and eggs.

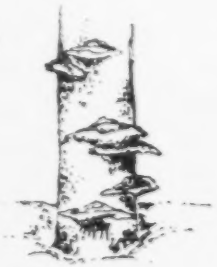
Shrubs such as dogwood, willow, and hazelnut provide twigs for browsing herbivores.



Deer and moose strip the terminal twigs, leaving a frayed end to the branch.

A pruning of the shrub layer is noticeable in areas of concentrated or protected moose populations; for example, in Elk Island National Park. A moose may eat as much as 22 kilograms (50 pounds) of twigs in one day.

Look for little teeth marks on bracket fungus. Deer mice sometimes forage for food above the snow. They in turn may become food for the great horned owl.



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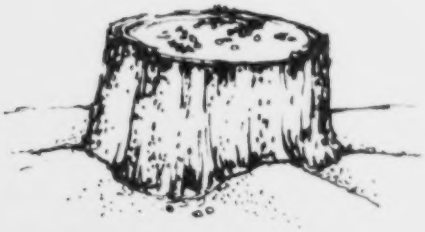
Seeds are small, high-energy food packets. Squirrels are adept at getting seeds from cones. With their sharp teeth, they strip the scales from spruce or pine cones and remove the seeds, as we would eat corn-on-the-cob. Look for a squirrel's "dining-room table" and notice all the "crumbs" left behind.



Squirrels harvest and store great quantities of cones, hazelnuts, and dried mushrooms in caches. Their snow-covered underground "pantry" and cone-strewn eating mound is called a midden.

99

Many ornamental shrubs and trees produce winter food that was made in the summer. The Bohemian waxwing migrates irregularly to find winter food sources. Mountain ash berries attract large flocks of them to urban gardens and boulevards. Look for evidence of these "sloppy" berry-eaters on the snow under a mountain ash tree. A bunch of feathers may tell another chapter in the food-chain story. The merlin, a falcon sometimes called a pigeon hawk, captures waxwings as a diet item.

⑤ A WEB OF LIFE

Air

Water

Animals

Minerals

Plants

Soil

Does water affect air? animals? soil? plants? minerals?
Connect the dots until you have a web of many interrelationships.
Where do we fit in?

101

EXPLORING THE WEB OF LIFE CONCEPT:

The process of developing whole earth perspectives — seeing world connections in a flake of snow - is an ongoing experience.

specific ⟷ general

concrete ⟷ abstract

trees ⟷ forest

resident ⟷ community

piece ⟷ whole

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4. Make a food chain or web including some of the things seen during the outing. Where do we fit in a food chain or web?

1 3

Field sheet: detach and fold

FIELD DETECTIVES

1. Find and list clues to ways animals depend on plants in winter.

2. Find and list clues to ways animals affect plants.

Field sheet: detach and fold

3. Find and list ways weather affects plants, animals, soil, and water.

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⑥ A MOUSE TALE

A long time ago, according to a West Coast legend, the Great Spirit was sitting on a hill. His back was propped against one of the very large Douglas Fir trees that grow in British Columbia and some places in Alberta. He was thinking about the whole world, but many little mice kept bothering him. They ran all over him - over his feet, his face, through his hair.

The mice did not heed when the Great Spirit asked them to leave him alone. Finally, he lost his patience and gave the mice one last chance — to the count of three or else!

"One... two... three..."

The mice were very frightened and disappeared immediately. With surprise, the Great Spirit looked all around to see where they had gone. They were nowhere in sight. Then he looked up into the Douglas Fir tree.

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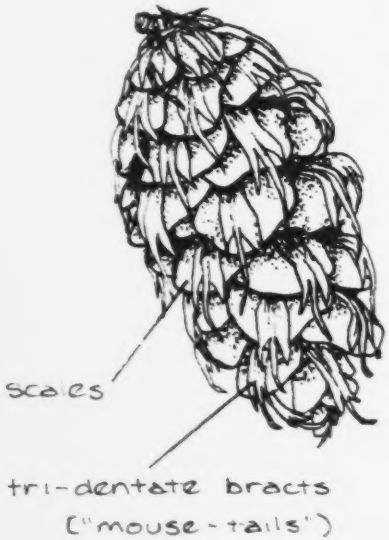
105

There were many cones on the tree, and there in the cones were the little mice hiding.

To this day, if you look at a Douglas Fir cone, you can still see the two hind feet and the little tail sticking out.



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⑦ BRANCHING OUT

MATH:

- Find young spruce trees and estimate their age by counting the whorls of branches on the trunk. The "candle" at the top represents the past season's growth. Add a year or two for getting started from seed to seedling.

  Yearly growing conditions can be detected by measuring and comparing the spaces on the trunk between each whorl. Growth rates may be graphed.

  Check weather records for dry, wet, hot, or cool growing seasons and relate to the evergreen trees in your study area.

-
-
-

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LANGUAGE ARTS:

- Is nature "dead" in winter? Use the phrase to write a composition on the deadness of winter. Write another composition to refute the implications of the phrase. Note the use of the word "dead" as a variation on a metaphor.
- Tell or write a legend about how the Balsam Poplar got its "Twiggy Faces."
- How "sense-able" are you? Visit a Christmas tree lot. Close your eyes and take a finger-tip walk from tree to tree. Have a buddy record as you describe your observations about how different trees and needles feel. For fun, try using alliteration to describe characteristics.
- Pretending to speak for an Aspen Poplar, or a dogwood, write about the visitors to the "Understory Cafeteria." Include a menu of available foods on a typical winter day. Like Jack Spratt who could eat no fat and his wife who could eat no lean, a diversity of animals can "lick the platter clean." Moose eat dogwood like candy, yet hares never touch it. Snowshoe hares

will strip the bark completely from young poplar branches and trunks.

SCIENCE:

- Try a sniffing walk, using the sense of smell to make observations about different kinds of trees. Use your hand to warm buds on twigs. Some twigs have a distinct odor which aids in recognizing the species.
- Expand on the idea of the Finger-Tip Identification and make a "sense-able" key to identifying Christmas trees, trees on the boulevard, or shrubs in a nearby park.
- Make bark rubbings and compare various types of bark. Observe the features that make each type of bark the same or different. How does bark help the trees survive in winter?
- "Interrelatedness." Keep that word in mind when exploring a tree and discovering signs of life in it, on it, under it, and around it. Just one tree may host a web of life for a whole community of organisms. A gall commonly occuring on conifers is often, at first glance, mistaken for a cone formation. On spruce trees, watch for enlarged and irregular

branch tips. They may be housing Adelges, a species of gall producing aphids. The galls do not cause serious injury to the tree.

SOCIAL STUDIES:

- In December, visit a Christmas tree lot to identify trees, consider the effect of the festive season on local economy, or compare folk ways at Christmas time in relation to coniferous tree distribution.
- Chew some "spruce gum," the aromatic resin that oozes out and seals off breaks in the bark. It has been useful as a glue to seal birch bark canoes. The pliable roots of the white spruce were used for lacing birch bark on canoes. Spruce tea has been recommended as a cure for scurvy.
- Rose hips are a source of vitamin C and make delicious tea. Visit a health food store and note the use of special plants for unique foods.
- When examining the shape of needles, why is it a good idea to pick up fallen needles rather than tearing them off living trees? A discussion might include development of attitudes and values, or the life-sustaining function of leaves to a tree and

resulting benefits to us.

- Look up the meaning of the word "midden" in a dictionary. It's a term used in archaeology and refers to kitchen heaps of previous cultures. As with the squirrel midden, much can be inferred about what was eaten by looking at what was left behind. Do you think an outer space archaeologist could find out about our eating habits by what we leave behind? in school yards? near fast food outlets?

V

OUT AND ABOUT

Opportunities for enjoying our affinity with the winter world are heightened by thoughtful preparations.

① PUT A TOQUE ON

There was an old man of Quebec,
Who was buried in snow to his neck.
When asked, "Are you friz?"
He replied, "Yes, I is,
But we don't call this cold in Quebec."
—Rudyard Kipling

There was a young man from the Yukon
Who thought there was a chinook on.
Outside in a trice
He froze solid as ice.
He'd be live if he'd just put his toque on.
—Isabel Miller, Edmonton

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"Put a hat on to keep your feet warm!"

This well-known adage is based on an understanding of how body heat is lost. To conserve heat and prevent cold misery and damage, become familiar with basic ways in which heat is lost:

- through exchange when a warm body is in contact with a colder object or surroundings:
  CONDUCTION
- by air movement or wind:
  CONVECTION
- by exposure to air colder than the body:
  RADIATION
- through breathing:
  RESPIRATION
- through perspiration or dampness:
  EVAPORATION

Winter clothing functions by keeping warm air in and cold air out. We have learned much about the layering principle from the original Arctic Canadians, the Innuit, who dressed in layers of skin and fur.

The insulating fur worn next to the body trapped heat in a thin layer of warm air and prevented contact with the cold surroundings (conduction). The outer skin kept the wind and wet from carrying heat away (convection, evaporation). The head, an excellent radiator of heat, was covered with a deep hood. Hooded protection around the face helped hold air warmed from breathing (respiration).

- How does the layering principle work?

  Take a look at how people are dressed for being outdoors. Make a list of inner and outer clothing items you consider necessary for beating the cold. How does each item conserve heat made by the body "furnace"?

- How can we make the best use of clothing we already have?

  Dress a mannequin, cardboard figure, or paper dolls with appropriate attire for being out and about

in freezing temperatures. Life-size mannequins may be designed by using broomsticks and newspaper-stuffed clothing for the body. A hooded jacket or snowmobile suit can hold a volleyball head and stuffed body intact. A series of paper dolls can show layers from under to outer wear.

- Which combination of clothing and environment is best for surviving the cold? Which is least effective?

Test the insulation value of different materials. Use plastic pill bottles or empty film cannisters as "little animals". Fill cannisters with water or liquid jello. Clothe each little animal with a different kind of material. Leave some without clothing and others without a "hat" or lid on.

Place containers outdoors in the cold and watch what happens. Do they all freeze? Do they freeze at the same rate? Which ones stayed warm the longest?

This experiment may be extended

by placing containers in different micro-climates — under the snow, in a tree, in the open, against the building, in a quin-zhee.

How can an experiment like this help us select appropriate clothing? How does it help us understand how animals cope?

- Do different kinds of fabrics have different insulating qualities?

  Wool is highly recommended because it dries from within, providing warmth to the body while it draws moisture away from the body by its unique "wicking" action.

- Why are mitts warmer than gloves?

  How are gloves like a big house with a tiny furnace? Or mitts like a tiny house with a large furnace? The same principle of surface-to-volume ratio applies to mice and moose.

- When are two pairs of mitts better than one? How many pairs of socks do you need to wear? Why are insoles such a good idea? What

about boot size?

It might be better to wear extra socks ever the boots rather than squeezing air spaces in a tight-fitting boot.

- How does wearing a hat or toque help regulate body temperature?

When more heat is being lost from the body than is being produced, the hands and feet cool first so that more warm blood can be sent to the body core. The brain and vital organs must be maintained at a temperature of about 37° C for normal functioning.

"When your feet are cold, put a hat on... when your feet are hot, take it off."

What about the adage, "cold hands, warm heart"?

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Keeping warm depends on:

FABRIC

- clothing to conserve body heat;

FOOD

- proper nutrition to "fuel" the body "furnace"; and

FITNESS

- efficient use of food energy.

② THINK C-O-L-D TO KEEP W-A-R-M ???

Create acronyms to think **COLD** and be **WARM**.

Winter Adaptation Really Matters !

Clothing (Clean and dry) insulates against Cold and Conserves body heat.

Overdress for Outings, but avoid Overheating and Overexertion.

Layers of clothes - not too tight and not too Loose - trap more air than a single thick Layer.

Decide on a Diet which will provide needed energy.

③ SNOWSHOEING

Snowshoes! Oh, how large you are.
Sure glad I don't have to go too far.
If it weren't for you I'd never've seen
Tracks in the snow where animals
had been.
A meadow mouse home, a porcupine
in a tree –
Those were delightful for me to see.
You came off so many a time,
But now that I think of it,
I don't really mind.

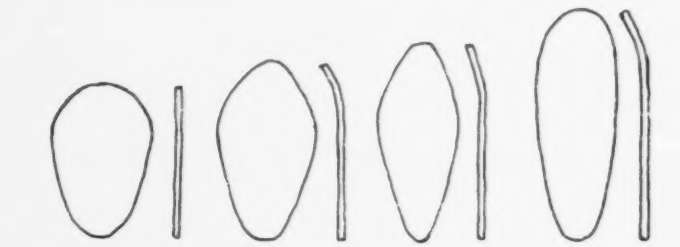
This poem exemplifies the wonderment of the grade 5 author's experience with snowshoes. Snowshoeing is a real link with history. Snowshoes are an invention with a long heritage – foot extenders as an adaptation for moving about in a snow-covered land.

Indian tribes developed and refined different styles and shapes of snowshoes to suit the snow conditions and the terrain of their region. A

snowshoer trying to manoeuvre through bush and around trees soon understands the advantages of the broad and flat "bear paw" shape. The narrow, long-tailed model with up-turned tips was designed for trailing across open spaces. A closely-woven mesh is best for dry, powdery snow; a coarser mesh for wet and crusty snow. Imagine Indian hunters on snowshoes, able to move quickly across the snow, felling their game at close range with bow and arrow.

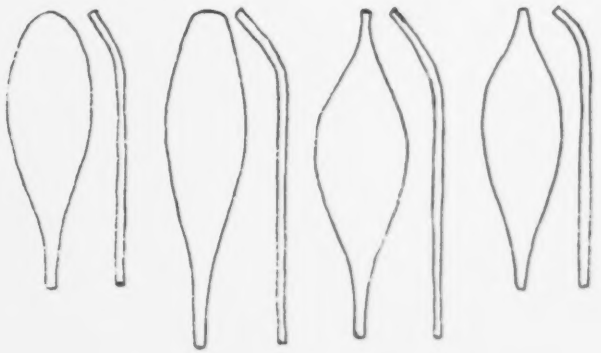
The many names for snowshoes may be confusing, since these names reflect the different origins, materials, and design. Each tribe followed its own patterns and established its own traditions in snowshoes. The utility and elegance of snowshoes was most highly developed in areas of consistently high and soft snowfall. In the Arctic region, where the snow is hard and wind-driven, sleds developed by the Innuit proved to be an effective means of travel.

SNOWSHOE SHAPES



bear paw — otter

bear paw variations



Algonquin
Maine
Michigan
beavertail

Alaskan
Yukon
pickerel

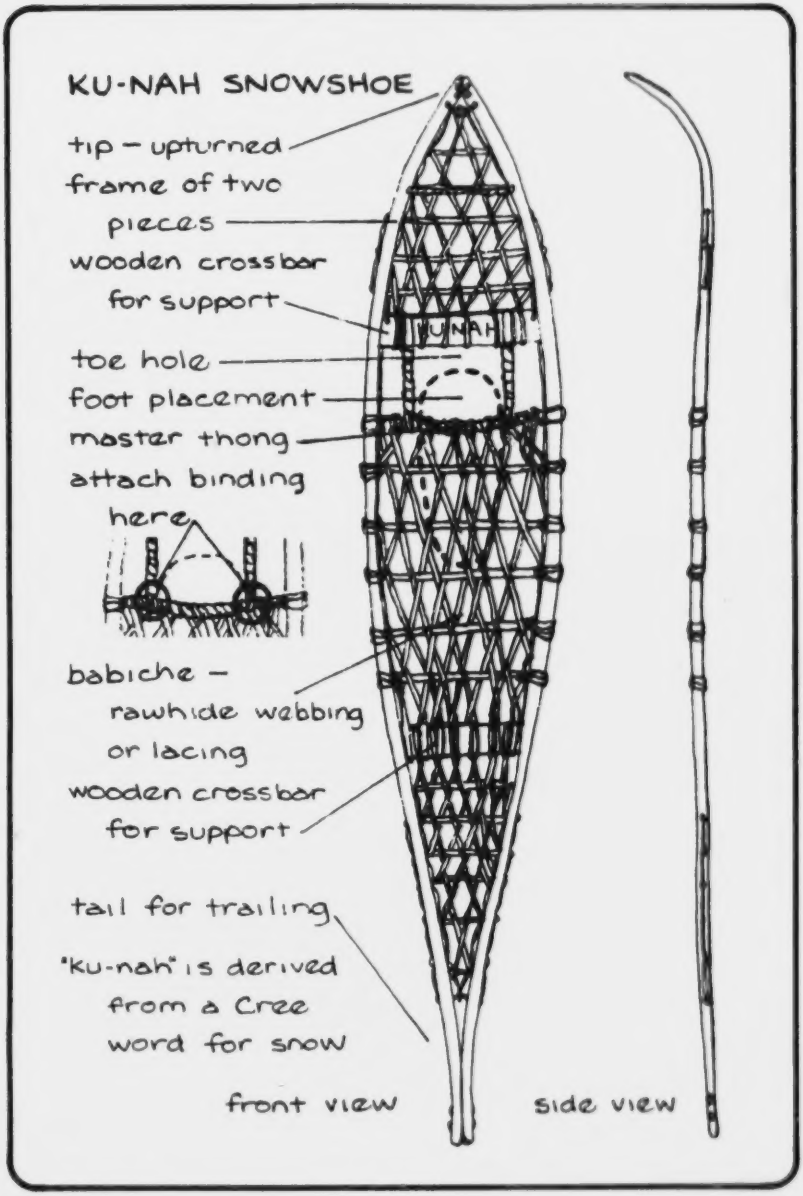
Ojibwa

Cree

teardrop variations

Ku-nah is the trade name given to the traditional Cree design snowshoe being made by hand at Calling Lake in Alberta. Ash is usually cited as the material used in snowshoe frames. Since ash trees are not native to Alberta, the ku-nah has a frame of birch wood. Moose hide and cowhide are both used to make the large area of webbing.

Although some modern snowshoes are all plastic, or aluminum frames with neoprene webbing, the basic idea of the "big foot" has remained unchanged for thousands of years. The snowshoe is a time-honoured vehicle for study, work, sport, and play. It offers an efficient means for enjoyable outdoor activities and an opportunity to tune in with nature in winter.


KU-NAH SNOWSHOE
tip – upturned
frame of two pieces
wooden crossbar for support
toe hole
foot placement
master thong
attach binding here
babiche – rawhide webbing or lacing
wooden crossbar for support
tail for trailing
"ku-nah" is derived from a Cree word for snow
front view
side view

④ A QUIN-ZHEE

The quin-zhee is an Indian-style snow shelter made by heaping snow into a large pile and hollowing out the interior.

Choose a site where the snow cover is unobstructed and has not been disturbed. Pile up a mound of snow, about 2 metres high and 3 or 4 metres in diameter. Let the pile of snow set before tunneling into it. The greater the difference in shape and temperature of the snow crystals near the surface and near the ground, the more recrystalizing will occur in the mixed snow pile. The mound will set in an hour or so when it's really cold.

Begin burrowing through a hole in the mound at ground level. Keep the entrance just big enough for one person to crawl in. Start to hollow out overhead, leaving the bottom layer

for support to the last. You can tell the right thickness of the walls when you see the outside light beginning to glow through. At least 20 cm. of snow wall is needed to insulate the inside from the outside.

Close the entrance with a block of snow or a backpack and make a small hole for ventilation at the top. Just like the pukak layer, the quin-zhee, if built in the shade, can provide shelter all winter long. Inside temperatures will be more moderate than those outside, especially when warmed by several occupants.

Start developing quin-zhee building know-how in a backyard or school courtyard. Try a sleepout in a backyard quin-zhee before attempting a wilderness sleepout. Use insulating foam pads to prevent heat loss through the bottoms of sleeping bags. Try a candle or two for creating a cozy atmosphere.

Alice in Wonderland changed size and entered a rabbit's burrow. Alice in Winterland needs only to enter a quin-zhee to experience the subnivean (under snow) world of the deer mouse. The environment in a quin-zhee is like that of the mouse under the snow blanket. The snow cover limits light, muffles noise, and entraps moist air.

⑤ A WINTER EXPERIENCE CHECKLIST

SKILL AREAS:

Awareness (observation)
- using the senses as "tools"
- comparing similarities and differences
- detecting changes
- gathering data, "reading" the clues

Appreciation (affective)
- finding enjoyment in one's surroundings
- caring about a quality environment

Problem solving (cognitive)
- interpreting data
- making hypotheses and investigating interrelatedness
- generalizing and predicting

Activity (psychomotor)
- moving - indoors and outdoors
- using equipment and materials

RESPONSIBILITIES:

People - taking care of ourselves and each other
- dressing appropriately for the weather and the activity
- using a "buddy" system for sharing and safety

Equipment - taking care of snowshoes, thermometers, and other materials
- choosing suitable vehicles for the purpose and conditions
- using equipment appropriately
- being accountable for items used individually and collectively

Environment - taking care of the area you are in
- practicing "good manners" to minimize impact on an area
- respecting the environment as a "home for plants and

animals

- collecting may be tempting— think of berries or shelf fungi as necessary winter food for a squirrel or a deer mouse
- protecting the snow "blanket"— compaction of snow cover may be a matter of life or death to plants and small animals
- preserving outdoor areas for all of us to enjoy

⑥ WINTER READING

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